Akshat Dave

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Research Goals

My research aims to create **vision systems** that can *see the invisible*—beyond line-of-sight, beneath surfaces, and at high speeds—through the synergistic co-design of **computational imaging** hardware with **differentiable simulations** and **physics-based machine learning** algorithms.

Current Appointment

Massachusetts Institute of Technology — Cambridge, MA
Postdoctoral Associate, MIT Media Lab — 2023 - Present
Advisor: Ramesh Raskar

Education

Rice University — Houston, TX
Ph.D. in Computer and Electrical Engineering — 2017 - 2023
Advisor: Ashok Veeraraghavan

Indian Institute of Technology Madras — Chennai, India
M.Tech. and B.Tech. in Electrical Engineering — 2012 - 2017
Advisor: Kaushik Mitra

Honors and Awards

Ralph Budd Award for the best engineering Ph.D. thesis at Rice University. 2024

INK Fellowship recognizing young achievers redefining their fields. 2024

ACM SIGGRAPH Asia Doctoral Consortium for PhD thesis research. 2023

Lodieska Stockbridge Vaughn Fellowship for outstanding graduate research. 2023

Rice D2K Research Mentoring Fellowship for applied data science innovation. 2023

Best Student Paper Prize at the Optica Imaging and Applied Optics Congress. 2020

Texas Instruments Fellowship for Ph.D. thesis research. 2017

Qualcomm Innovation Fellowship for Masters thesis research. 2016

Svaagata Erasmus Mundus Scholarship for semester exchange in Stockholm. 2015

KVPY National Fellowship for research by the Government of India. 2011

Publications Summary

23 peer-reviewed publications across computer vision (CVPR, ICCV, ECCV), computer graphics (TOG), and optics/imaging (Optics Express, ICCP, TCI) venues—including **9** first-author papers (1 best paper prize) and **9** papers (3 under review) with my advised mentees as first authors.

Grants

Generative Cameras: Automated Camera Design for Next-generation XR by Leveraging AI as a Scientist 2024
Samsung Research America, $150,000
Role: Co-investigator

Distributed and Private ML for Automotive Datasets 2024
Hyundai America Technical Center, $250,000
Role: Co-investigator

A Roadmap for Generative Design of Visual Intelligence 2024
An MIT Exploration of Generative AI, Seed Grant, $70,000
Role: Co-investigator

Mentorship

Graduate Research Mentor

Hank Lin, MIT	ICCP 2024
Zaid Tasneem, Rice	ECCV 2024
Siddharth Somasundaram, MIT	CVPR 2023
Kushagra Tiwary, MIT	CVPR 2023
Tianyi Zhang, Rice	ICCP 2022

Undergraduate Research Mentor

Nikhil Behari, Harvard → MIT	CVPRW 2024
Chaitanya Kapoor, BITS Pilani → UCSD	2024
Evelyn Zhu, MIT	2024
Abbas Shaikh, Rice	2023

Research Mentoring Fellow
Abdullah Zaher, Bridget Lee, Harry Golen, Natan Rivera 2023
Rice D2K Lab Capstone Program with Houston Fire Department

Teaching

Instructor
Polarization-based Visual Computing, SIGGRAPH Course 2023

Teaching Assistant

Introduction to Computer Vision, Rice University	2020
Computational Imaging, Rice University	2019
Fundamentals of Electrical Engineering, Rice University	2018
Machine Learning for Computer Vision, IIT Madras	2016
Data Structures and Algorithms, IIT Madras	2016

Theses

Seeing the Invisible: Next-generation vision systems leveraging polarization and time-of-flight of light (Ralph Budd Thesis Award) 2023
Ph.D Thesis, Rice University

Compressive and Coded Image Recovery using Deep Recurrent Priors 2017
(Qualcomm Innovation Fellowship)
Masters Thesis, Indian Institute of Technology Madras

Manuscripts Under Review

* indicates equal contribution and † indicates advised student

Blurred LiDAR for Sharper 3D: Robust Handheld 3D Scanning with Diffuse LiDAR and RGB 2024
N. Behari†, A. Young, S. Somasundaram, T. Klinghoffer, **A. Dave**, R. Raskar

Enhancing Autonomous Navigation by Imaging Hidden Objects using Single-Photon LiDAR 2024
A. Young*†, N. M. Batagoda*, H. Zhang, **A. Dave**, A. Pediredla, Dan Negrut, R. Raskar

Event Cameras Meet SPADs for High-Speed, Low-Bandwidth Imaging 2024
M. Muglikar†, S. Somasundaram, **A. Dave**, E. Charbon, R. Raskar, D. Scaramuzza

Publications

* indicates equal contribution and † indicates advised student

NeST: Neural Stress Tensor Tomography by leveraging 3D Photoelasticity TOG 2024
A. Dave, T. Zhang*, A. Young*, R. Raskar, W. Heidrich, A. Veeraraghavan
Accepted for ACM Transactions on Graphics

A Roadmap for Generative Design of Visual Intelligence MIT 2024
K. Tiwary †, T. Klinghoffer, A. Young, S. Somasundaram, N. Behari,
A. Dave, B. Cheung, D. Nilsson, T. Poggio, R. Raskar
An MIT Exploration of Generative AI: From Novel Chemicals to Opera, MIT Press

Handheld Mapping of Specular Surfaces using Consumer-Grade Flash LiDAR ICCP 2024
T. Lin †, C. Henley, S. Somasundaram, **A. Dave**, M. Laifenfeld, R. Raskar
IEEE International Conference on Computational Photography 2024

DecentNeRFs: Decentralized Neural Radiance Fields from Crowdsourced Images ECCV 2024
Z. Tasneem †, **A. Dave**, A. Singh, K. Tiwary, P. Vepakomma, A. Veeraraghavan, R. Raskar
European Conference on Computer Vision 2024

SUNDIAL: 3D Satellite Understanding through Direct Ambient and Complex Lighting Decomposition CVPRW 2024
N. Behari †, **A. Dave**, K. Tiwary, W. Yang, R. Raskar
Earthvision CVPR Workshop 2024

First-Arrival Differential Counting for SPAD Array Design Sensors 2023
M. White, T. Zhang, **A. Dave**, S. Ghajari, A. C. Molnar, A. Veeraraghavan
MDPI Sensors Special Issue 2023

ORCa: Glossy Objects as Radiance Field Cameras (MIT Frontpage Spotlight) CVPR 2023
K. Tiwary*, **A. Dave***, N. Behari, T. Klinghoffer, A. Veeraraghavan, R. Raskar
IEEE/CVF Conference on Computer Vision and Pattern Recognition 2023

Role of Transients in Two-Bounce Non-Line-of-Sight Imaging CVPR 2023
S. Somasundaram†, **A. Dave**, C. Henley, A. Veeraraghavan, R. Raskar
IEEE/CVF Conference on Computer Vision and Pattern Recognition 2023

PANDORA: Polarization-Aided Neural Decomposition Of Radiance ECCV 2022
A. Dave, Y. Zhao, A. Veeraraghavan
European Conference on Computer Vision 2022

Snapshot Polarimetric Diffuse-Specular Separation OE 2022
A. Dave, Y. Hold-Geoffroy, M. Hašan, K. Sunkavalli, A. Veeraraghavan
Optica Optics Express 2022

First Arrival Differential LiDAR ICCP 2022
Tianyi Zhang†, Mel White*, **A. Dave***, S. Ghajari, A. Raghuram, A. Molnar, A. Veeraraghavan
International Conference on Computational Photography 2022

A Differential SPAD Array Architecture in 0.18 um CMOS for HDR Imaging ISCS 2022
M. White, S. Ghajari, Tianyi Zhang, **A. Dave**, A. Veeraraghavan, A. Molnar
International Symposium on Circuits and Systems 2022

A Deep Network-based Image Processing Framework for Thermal Images ICCVW 2021
V. Saragadam, **A. Dave**, A. Veeraraghavan, R. Baraniuk
Learning for Computational Imaging Workshop at ICCV 2021

Foveated Non Line of Sight Imaging (Best Student Paper Prize) COSI 2020
A. Dave, M. Balaji, P. Rangarajan, A. Veeraraghavan, M. Christensen
Opti Imaging and Applied Optics Congress 2020

Convolutional Approximations to the General NLOS Imaging Operator (Oral) ICCV 2019
B. Ahn, **A. Dave**, A. Veeraraghavan, I. Gkioulekas, A. C. Sankaranarayanan
International Conference of Computer Vision 2019

SNLOS: Non-line-of-sight Scanning through Temporal Focusing ICCP 2019
A. Pediredla*, **A. Dave***, A. Veeraraghavan
International Conference on Computational Photography 2019

Solving Inverse Computational Imaging Problems Using Deep Pixel-Level Prior TCI 2018
A. Dave, A. K. Vadathya, R. Subramanyam, R. Baburajan, K. Mitra
IEEE Transactions on Computational Imaging 2018

SILC: Smoother Imitation with Lipschitz Costs ICMLW 2018
S. Chaudhary*, **A. Dave***, B. Ravindran
Workshop on Goal Specification in Reinforcement Learning at ICML 2018

Compressive Image Recovery Using Recurrent Generative Model ICIP 2017
A. Dave, A. K. Vadathya, K. Mitra
IEEE International Conference on Image Processing 2017

IITMSAT Communications System - A LeanSat Design Approach USMCW 2015
A. Gulati, S. Chavan, **A. Dave**, et al.
IAA Conference on University Satellites Missions and CubeSat Workshop 2015

Invited Talks

Computer Graphics Seminar, POSTECH South Korea — Jul 2024
Host: Seung-Hwan Baek

Invited Talk, CVPR CCD Workshop — Jun 2024
Hosts: Salman Asif, Yi Xue, Mark Sheinin, Kristina Monakhova

Invited Talk, Janelia Computational Optics Conference — May 2024
Hosts: Srini Turaga, Hari Shroff, Ruth Sims, Laura Waller

Invited Talk, Meta Polarization Workshop — Feb 2024
Host: Onur Akkaya

Doctoral Consortium Talk, SIGGRAPH Asia — Dec 2023
Hosts: Aaron Quigley, Mashhuda Glencross, Simon See

ECE Group Talk, University of Washington Seattle — Aug 2023
Host: Arka Majumdar

Grundfest Lecture Series, University of California Los Angeles — Apr 2023
Host: Achuta Kadambi

PixelCafe Seminars, University of California San Diego — Feb 2023
Host: Manmohan Chandraker

Computational Imaging Group Talk, Stanford University — Jan 2023
Host: Gordon Wetzstein

Computer Graphics Group Talk, Massachusetts Institute of Technology — Sep 2022
Host: Fredo Durand

Graphics Talk, Carnegie Mellon University — Aug 2022
Host: Ioannis Gkioulekas

Computational Imaging Group Talk, University of Maryland College Park — Apr 2022
Host: Chris Metzler

Professional Service

Publications Chair
IEEE ICCP 2024

Organizer
Workshop on Neural Fields Beyond Conventional Cameras, ECCV 2024
Workshop on Extreme Sensing, MIT Media Lab Fall Meeting 2023

Journal Reviewer
ACM Transactions on Graphics
IEEE T. Pattern Analysis and Machine Intelligence
IEEE T. Computational Imaging
IEEE Signal Processing Letters
Optica Applied Optics
Nature Communications

Conference Reviewer
SIGGRAPH
SIGGRAPH Asia
ICCP
CVPR
ECCV
IROS

Other Research Experience

Massachusetts Institute of Technology — Cambridge, MA
Visiting Student, MIT Media Lab — 2022
Advisor: Ramesh Raskar

Adobe Research — San Jose, CA
Research Intern — 2020
Manager: Kalyan Sunkavalli

KTH Royal Institute of Technology — Stockholm, SE
(Svaagata Erasmus Mundus Scholarship) — 2015
Semester Exchange Research
Advisor: Satyam Dwivedi

Patent Applications

First Arrival Differential LiDAR
A. Veeraraghavan, A. Molnar, M. White, T. Zhang, **A. Dave**, A. Raghuram, S. Ghajari — 2024
US Patent App. 18/676,223, 2024

Generating physically-based material maps
A. Dave, K. Sunkavalli, Y. Hold-Geoffroy, M. Hasan — 2022
US Patent App. 17/233,861, 2022

Media Coverage and Outreach

Superhuman Vision: AI sees what you can't — 2024
TEDxBoston Talk, 'Quin House Boston

Seeing Beyond: Unlocking the Invisible with AI — 2024
INK Fellow Talk, Bangalore, India

The Role of AI in Surgery — 2024
ISOPARB India Webinar

ORCa: Glossy Objects as Radiance Field Cameras — 2023
MIT Front Page Spotlight. Featured in SciTechDaily, MarkTechPost and more.

References

Ramesh Raskar (a3ramesh@media.mit.edu) — MIT
Associate Director and Associate Professor, MIT Media Lab
Massachusetts Institute of Technology

Ashok Veeraraghavan (vashok@rice.edu) — Rice
Department Chair and Professor, ECE Department
Rice University

Wolfgang Heidrich (wolfgang.heidrich@kaust.edu.sa) — KAUST
Professor, CS and ECE Departments
King Abdullah University of Science and Technology

Aswin Sankaranarayanan (saswin@andrew.cmu.edu) — CMU
Professor, ECE Department
Carnegie Mellon University